

## BONE CONDUCTION SPEECH AUDIOMETRY

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### Application

Patients with a high degree of hearing loss are frequently unable to differentiate between true hearing and tactile vibratory impulses as perceived during pure tone audiometry. These so-called "feeling curves" may wrongly indicate bone conduction hearing in the lower frequency range up till 1000 cps, which appears better than the case may be. This information may occasionally lead to a wrong indication for an operation aiming to improve hearing. During pure tone audiometry the patient answers "yes" or "no" not only on hearing but also on perceiving tactile impulses. Differentiation between true hearing and tactile perception is not always possible with this method. In these unclear cases no help could be expected from the usual air conduction speech audiogram. One should rather complete the examination with the bone conduction speech audiogram. Since words are to be repeated by the patient, one has the possibility to determine objectively whether the high bone conduction level is true or false. Similar examinations had been recommended by GOETZINGER & PROUD and TATO & ALFARO.

### Equipment and Technique

The usual air and bone conduction speech audiometry was performed with the Atlas Speech Audiometer EM 48 or the Beoton Speech Audiometer VG V in 50 normal hearing persons in a sound-proof room. Since the bone conduction receiver ZG 58 (measurable frequency range 100 — 12.000 cps!) requires a higher electrical output, we have coupled it with the output for the loudspeaker (impedance 4 Ohm), and we calibrated the output of the loudspeaker, now in use for the bone conduction receiver, in such a way that air and bone conduction curves overlapped. The maximal output was 115 db for air conduction and 85 db for bone conduction. In addition the bone conduction receiver was acoustically protected by a rubber tubing, so that it did not radiate back any strong airborne sound.

### Method of measurement

A typical pure tone audiogram in air and bone conduction is done at first and then follows air conduction speech audiogram. If the hearing loss is severe or unclear and asymmetrical then a bone conduction speech audiogram will be done as well. The bone conduction receiver is fixed on the mastoid with the help of a bow (pressure of 250 g/cm<sup>2</sup>) and the measurement process used in the normal air conduction speech audiogram is repeated. In Germany we determine the hearing loss for speech in dB by means of

numbers instead of spondees, and the discrimination loss in per-cent with mono-syllabic words similar to those of the PB-lists. With this test material we measure several points at different loudness levels. We write always two curves, one for the hearing loss and one for the discrimination loss. When dealing with asymmetrical hearing loss white noise should be used to mask the better hearing ear.

### Results

In symmetrical hearing impairment, i.e. in mild or moderate advanced disturbances of the inner ear with a dropping audiometric curve, and also in symmetrical bone conduction disturbances it is sufficient to perform only air conduction speech audiogram in addition to the usual pure tone audiogram. In all these cases with severe hearing impairment as well as in all cases with asymmetrical hearing loss the diagnosis might be clarified by a bone conduction speech audiogram. If we find an overlapping of the air and bone conduction curves it is clear that the relatively good bone conduction was perceived through tactile impression, and we are dealing

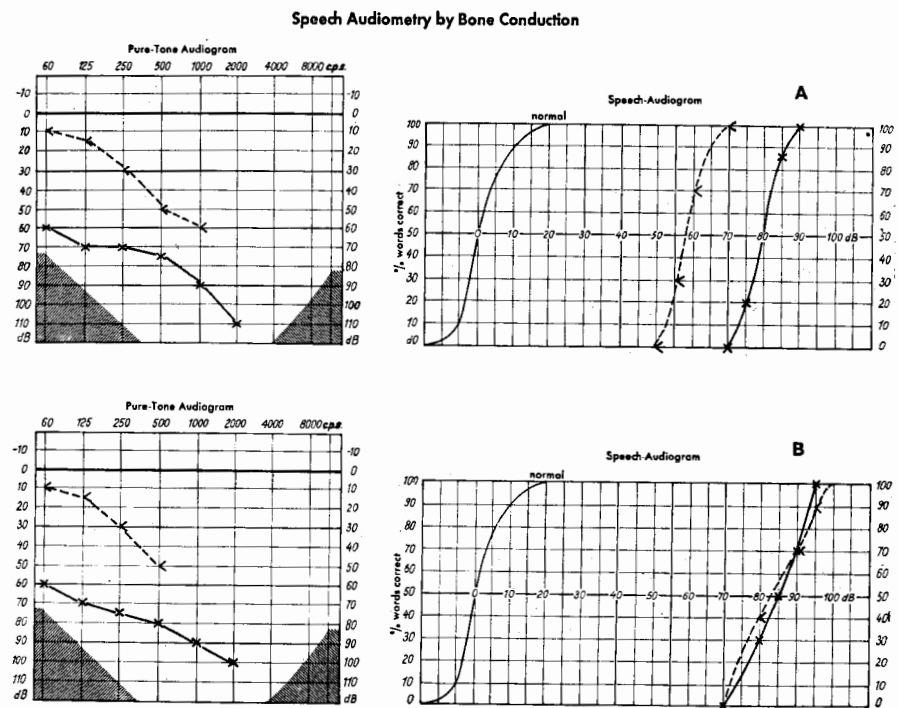


Fig. 1. The pure tone audiometry does not allow a differentiation between true hearing and tactile perception in bone conduction in cases with a high degree of hearing loss. The two audiograms on the left side seem to be identical.

The diagnosis in case A = mixed deafness and in case B = inner ear deafness was made by help of speech audiometry with numbers similar to the spondees as test material, not with PB words, therefore no discrimination loss in air- and bone-conduction.

with a purely inner ear hearing loss. The examination of bone conduction speech audiometry will reveal the exact bone conductive component of the hearing loss. In this way indications for surgery to improve hearing may be determined and more exact prognosis as to the postoperative hearing gain may be expressed. For the hard of hearing person even the slightest hearing gain is of decisive significance. Nowadays with the fine technique of stapedectomy and tympanoplasty it is important to be able to measure the hearing loss with a high accuracy.

Exact diagnosis and indication for such intervention may be determined only with the help of bone conduction speech audiometry. Surgery may be performed to-day on patients with a relatively small cochlear reserve. The scope of indication for surgery in these cases is markedly broadened. Patients who are not suitable for operation can be eliminated by bone conduction speech audiometry.

### **AUDIOMETRIE VOCALE EN CONDUCTION OSSEUSE**

Utilisant une audiométrie tonale, on peut obtenir des courbes dites "senties" en examinant des malades atteints d'une surdité complète. Chez des malades d'une surdité combinée grave, il est souvent impossible de juger si la conduction osseuse est réelle ou sentie. Des examens avec assourdissement ne donnent non plus des résultats définitifs. Dans des cas incertains de ce genre nous faisons des audiogrammes vocales en conduction aérienne et osseuse.

Pour l'audiométrie tonale il n'y a que les réponses "oui" et "non" tandis qu'en audiométrie vocale le malade doit répéter les mots, ce qui donne des résultats plus objectifs. Si les courbes de conduction osseuse et aérienne coïncident, il s'agit d'une surdité labyrinthique, tandis que si la courbe de conduction osseuse excède la conduction aérienne de l'audiogramme vocale démontre précisément la partie réelle de la perte par transmission et nous aide à obtenir des meilleures indications pour les interventions chirurgicales à l'oreille.

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